OIPE IAP45
MAY 22 2006
PATENT & TRADEMARK OFFICE

FIG. 1

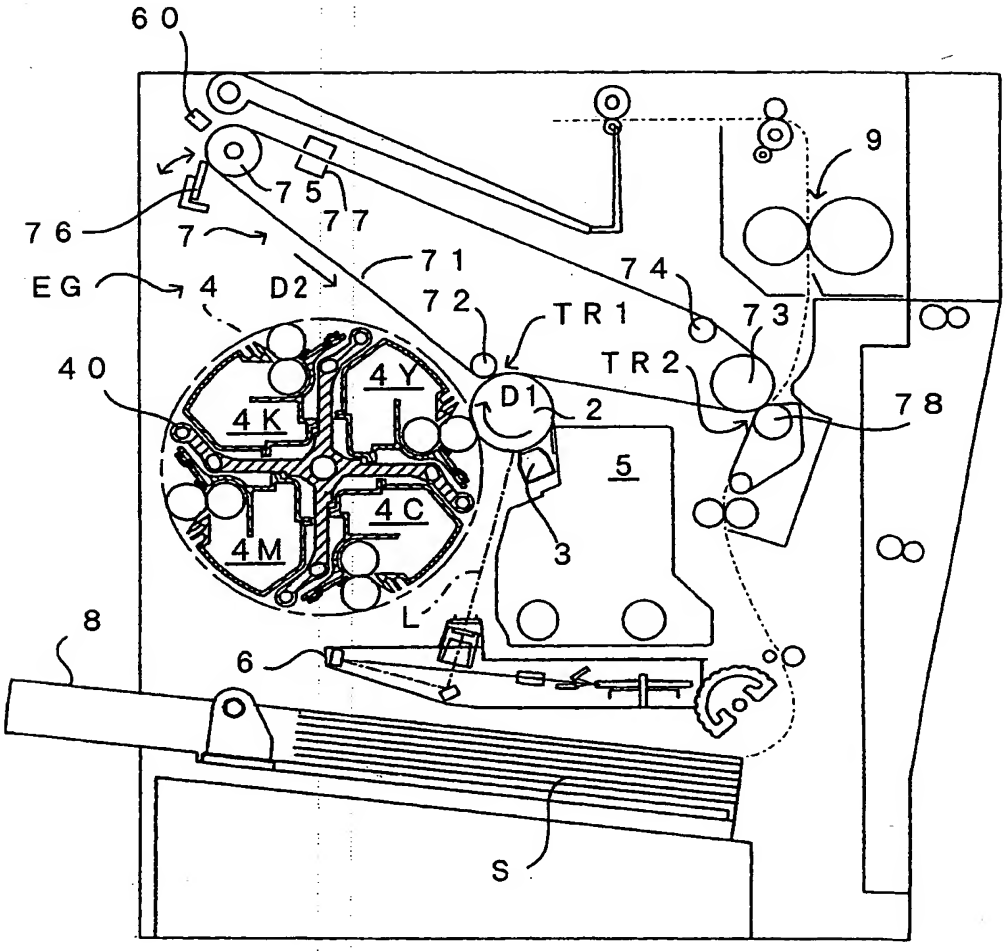


FIG. 2

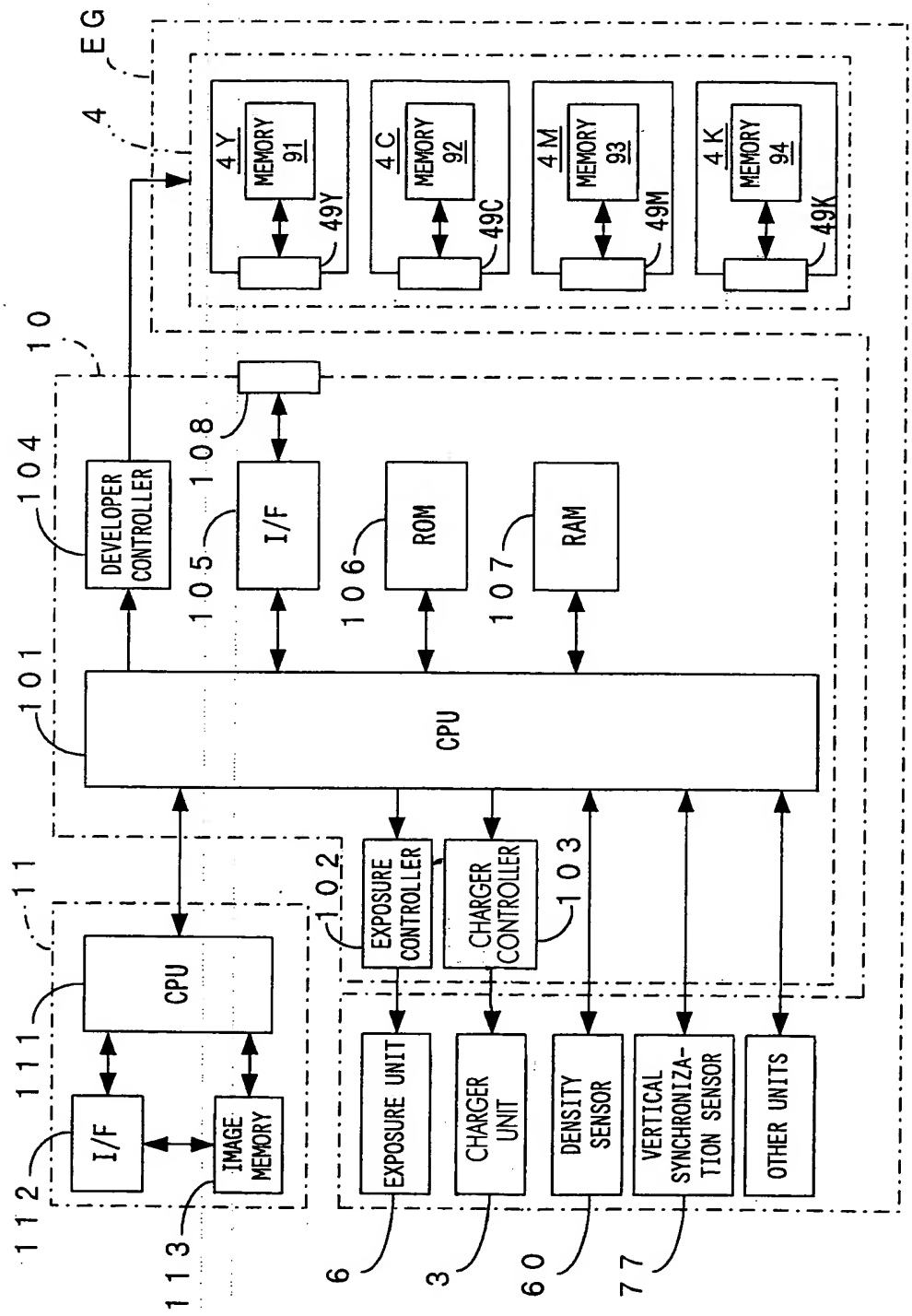

EG
4
4Y MEMORY 91
49Y
4C MEMORY 92
49C
4M MEMORY 93
49M
4K MEMORY 94
49K
10
104
DEVELOPER CONTROLLER
108
105
I/F
106
ROM
107
RAM
101
CPU
11
102
EXPOSURE CONTROLLER
CHARGER CONTROLLER
103
111
CPU
112
I/F
IMAGE MEMORY
113
EXPOSURE UNIT
CHARGER UNIT
DENSITY SENSOR
VERTICAL SYNCHRONIZATION SENSOR
OTHER UNITS
6
3
60
77

FIG. 3

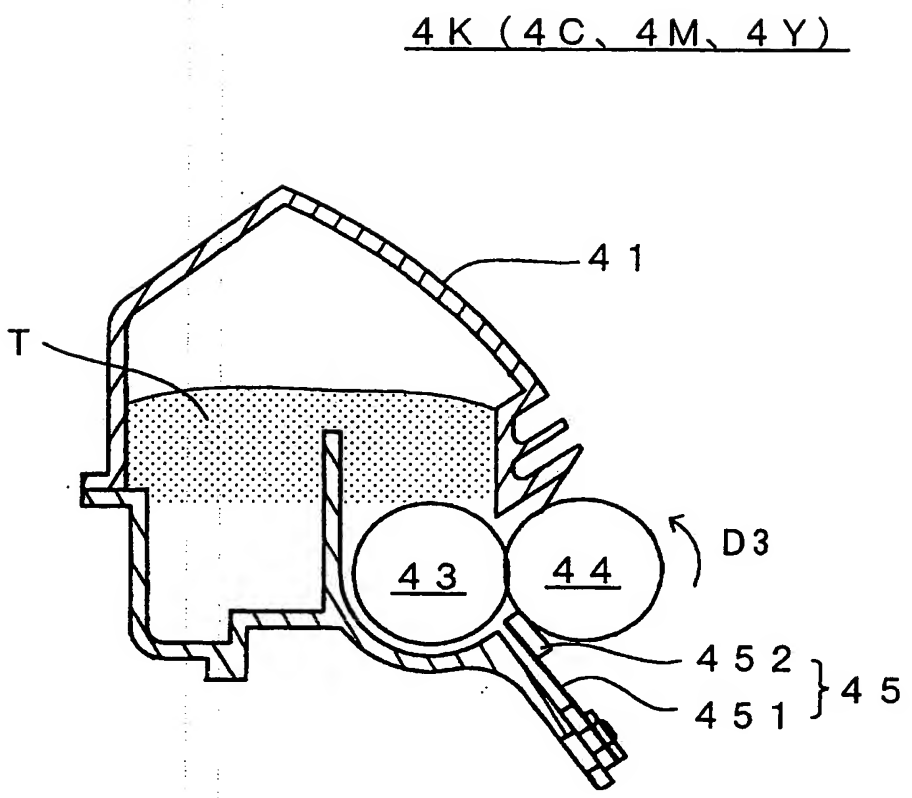


FIG. 4

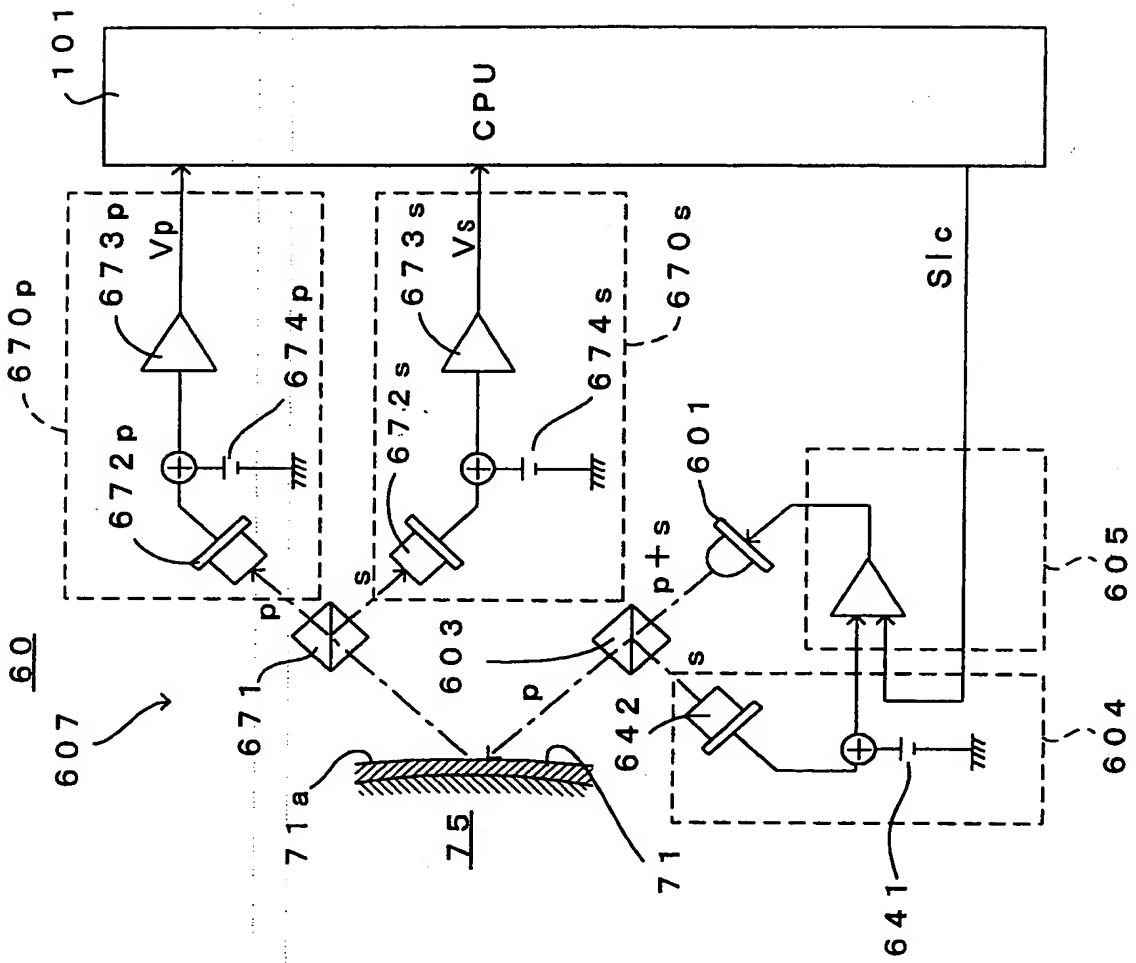

101
CPU
673p
Vp
673s
Vs
670p
670s
674p
674s
672p
672s
601
Slc
605
60
603
p+s
607
671
642
604
71a
75
71
641

FIG. 5

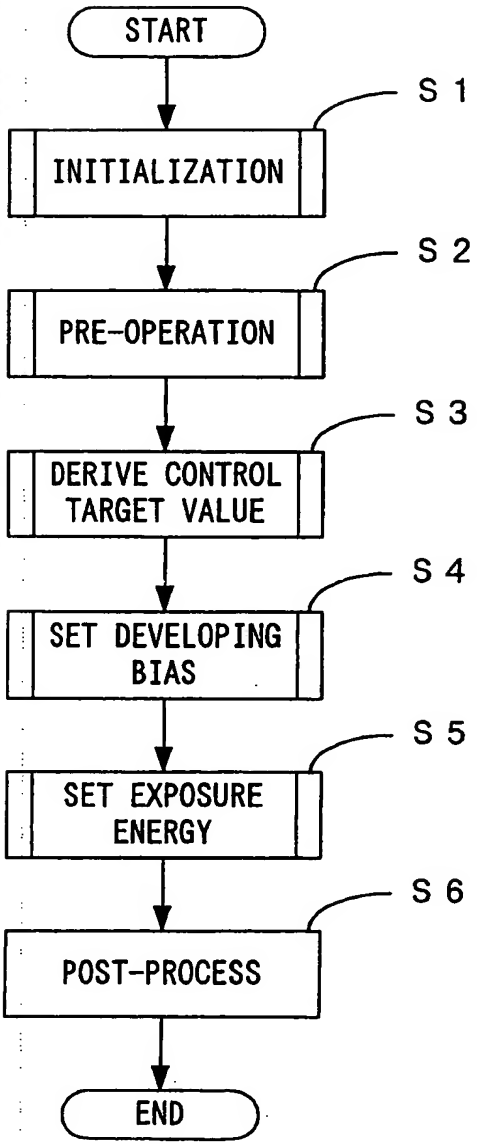

START
S 1
INITIALIZATION
S 2
PRE-OPERATION
S 3
DERIVE CONTROL TARGET VALUE
S 4
SET DEVELOPING BIAS
S 5
SET EXPOSURE ENERGY
S 6
POST-PROCESS
END

FIG. 6

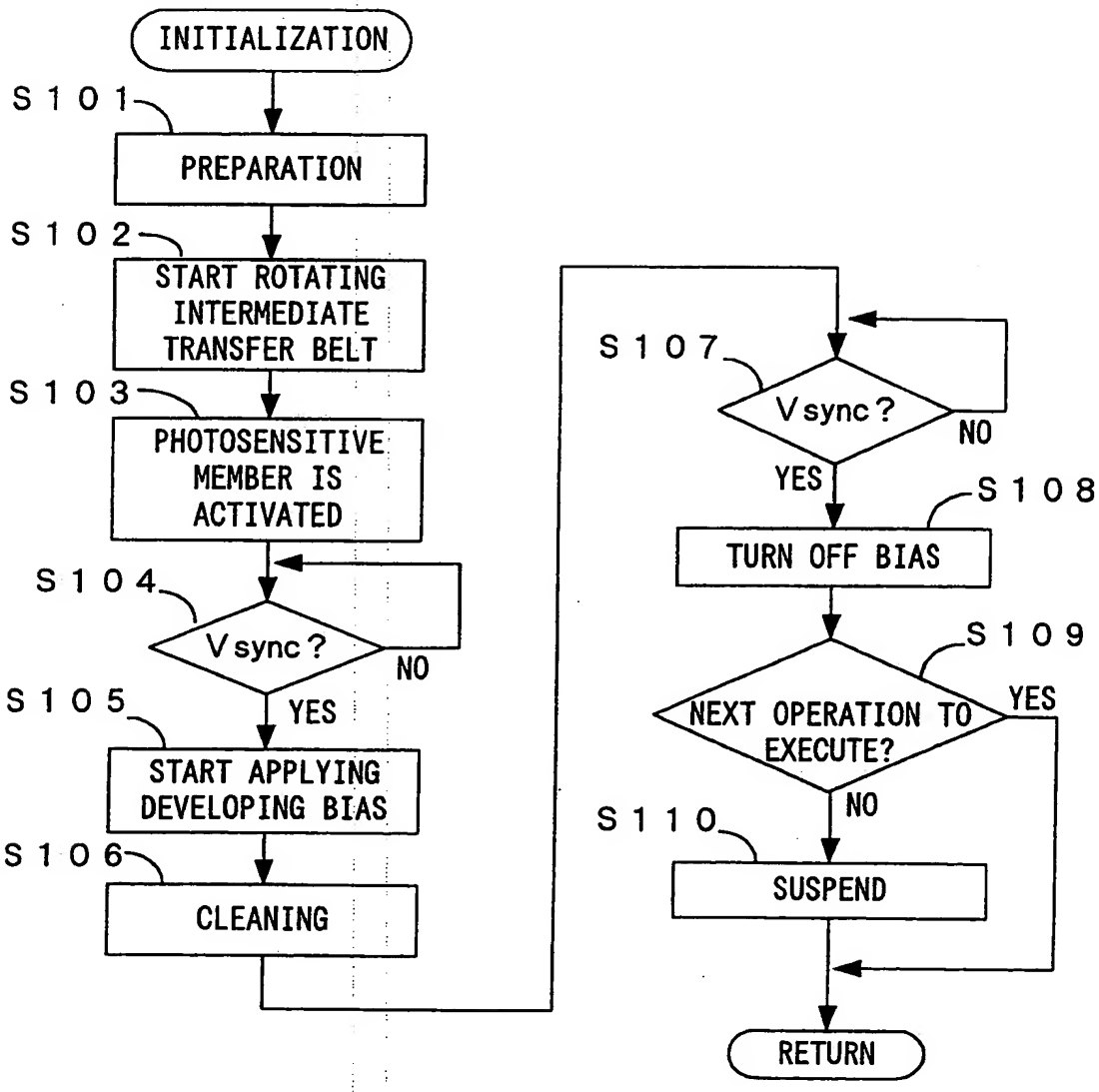

INITIALIZATION
S101
PREPARATION
S102
START ROTATING INTERMEDIATE TRANSFER BELT
S103
PHOTOSENSITIVE MEMBER IS ACTIVATED
S104
V sync ?
NO
YES
S105
START APPLYING DEVELOPING BIAS
S106
CLEANING
S107
V sync ?
NO
YES
S108
TURN OFF BIAS
S109
NEXT OPERATION TO EXECUTE?
YES
NO
S110
SUSPEND
RETURN

FIG. 7

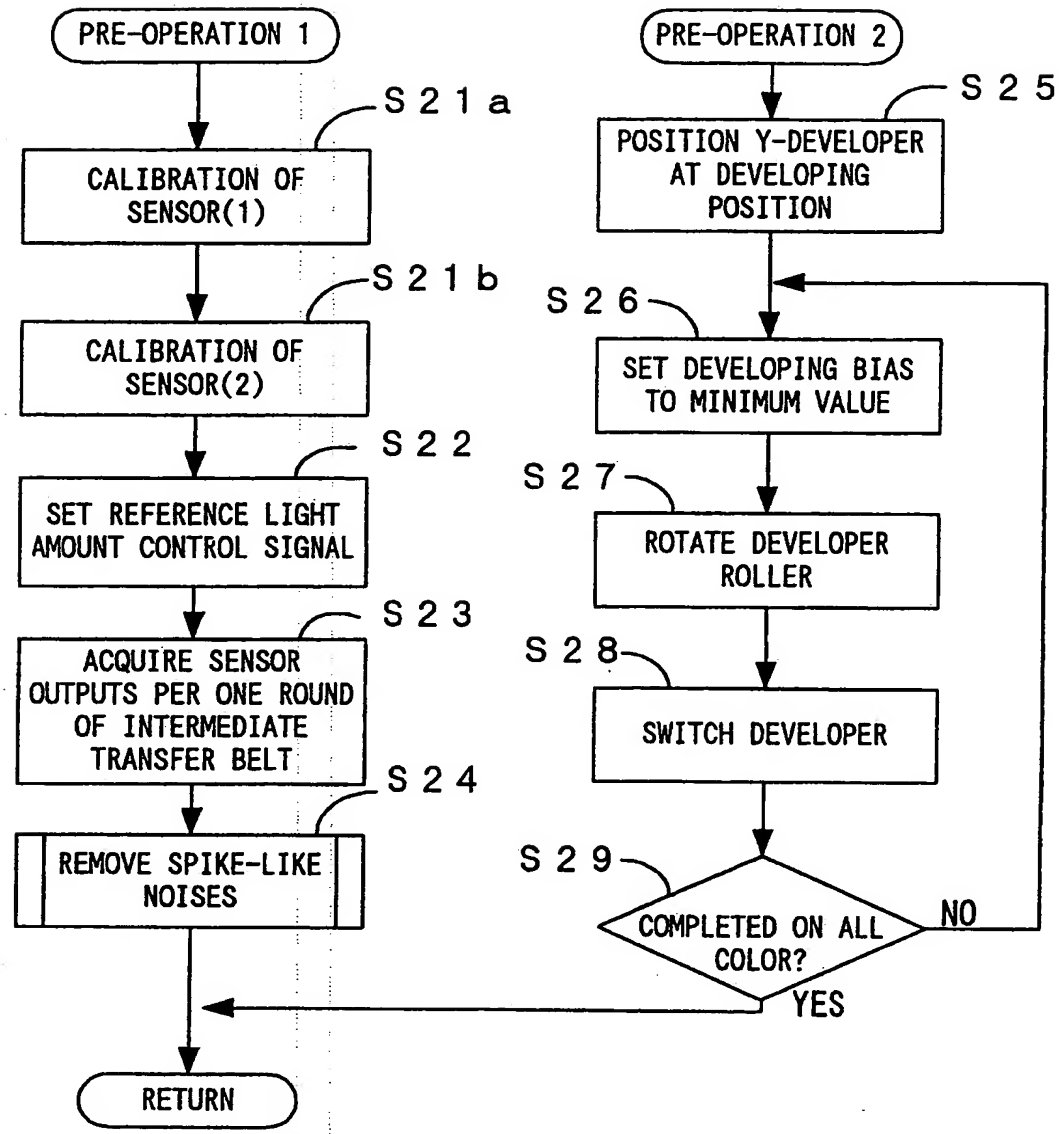

PRE-OPERATION 1
S21a
CALIBRATION OF SENSOR(1)
S21b
CALIBRATION OF SENSOR(2)
S22
SET REFERENCE LIGHT AMOUNT CONTROL SIGNAL
S23
ACQUIRE SENSOR OUTPUTS PER ONE ROUND OF INTERMEDIATE TRANSFER BELT
S24
REMOVE SPIKE-LIKE NOISES
RETURN
PRE-OPERATION 2
S25
POSITION Y-DEVELOPER AT DEVELOPING POSITION
S26
SET DEVELOPING BIAS TO MINIMUM VALUE
S27
ROTATE DEVELOPER ROLLER
S28
SWITCH DEVELOPER
S29
COMPLETED ON ALL COLOR?
NO
YES

FIG. 8A

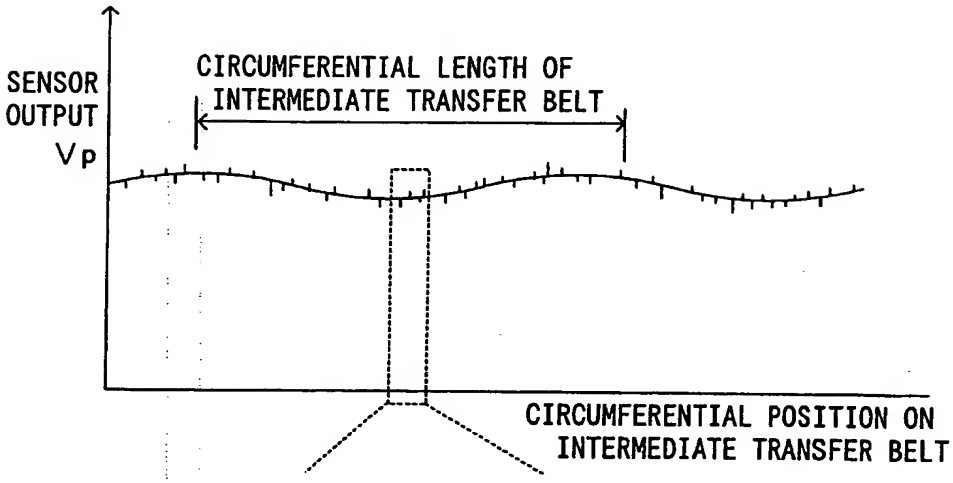

SENSOR
OUTPUT
Vp
CIRCUMFERENTIAL LENGTH OF
INTERMEDIATE TRANSFER BELT
CIRCUMFERENTIAL POSITION ON
INTERMEDIATE TRANSFER BELT

FIG. 8B

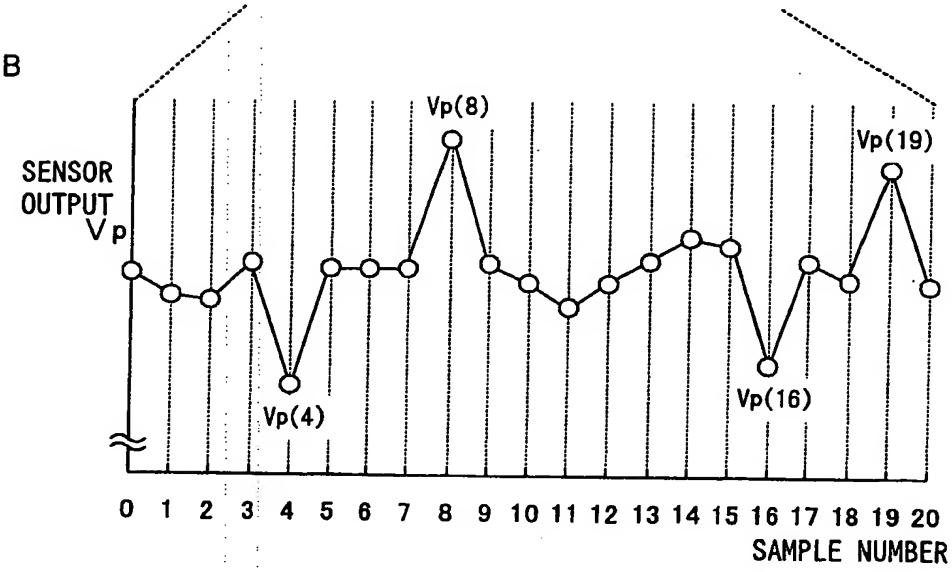

SENSOR
OUTPUT
Vp
Vp(8)
Vp(19)
Vp(4)
Vp(16)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SAMPLE NUMBER

FIG. 9

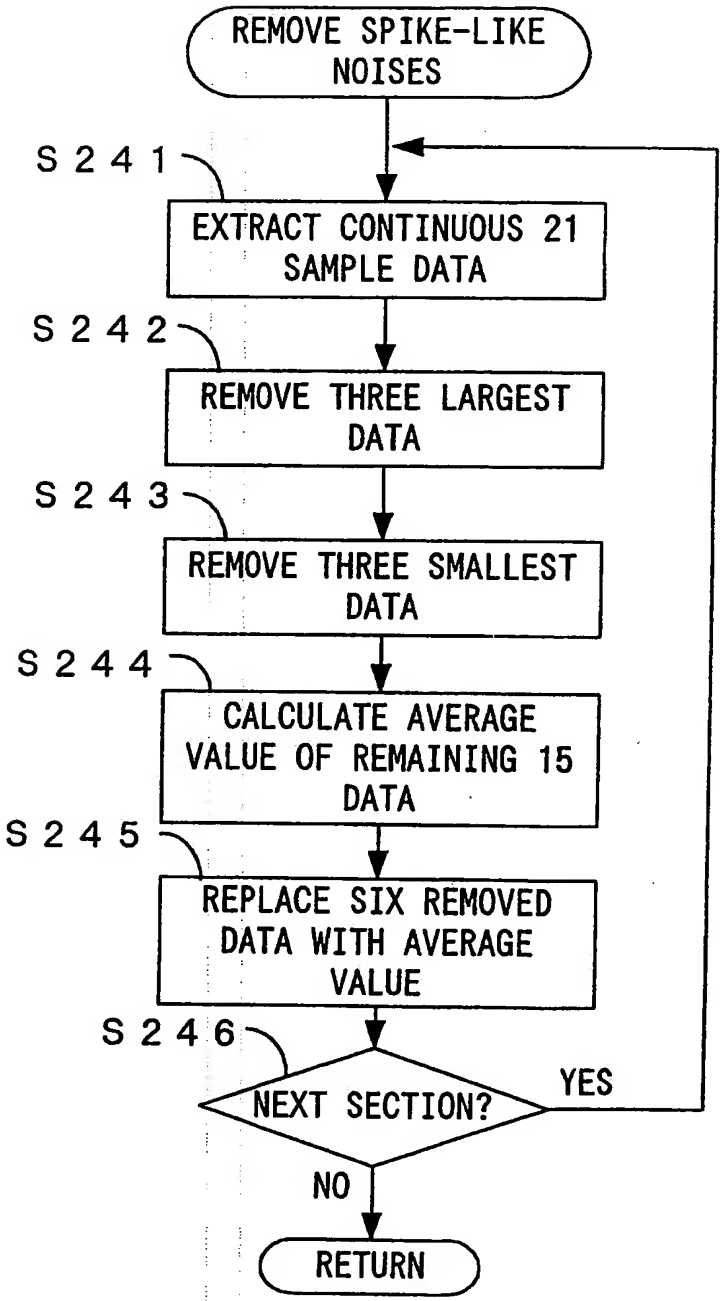

REMOVE SPIKE-LIKE NOISES
S241
EXTRACT CONTINUOUS 21 SAMPLE DATA
S242
REMOVE THREE LARGEST DATA
S243
REMOVE THREE SMALLEST DATA
S244
CALCULATE AVERAGE VALUE OF REMAINING 15 DATA
S245
REPLACE SIX REMOVED DATA WITH AVERAGE VALUE
S246
NEXT SECTION?
YES
NO
RETURN

FIG. 10

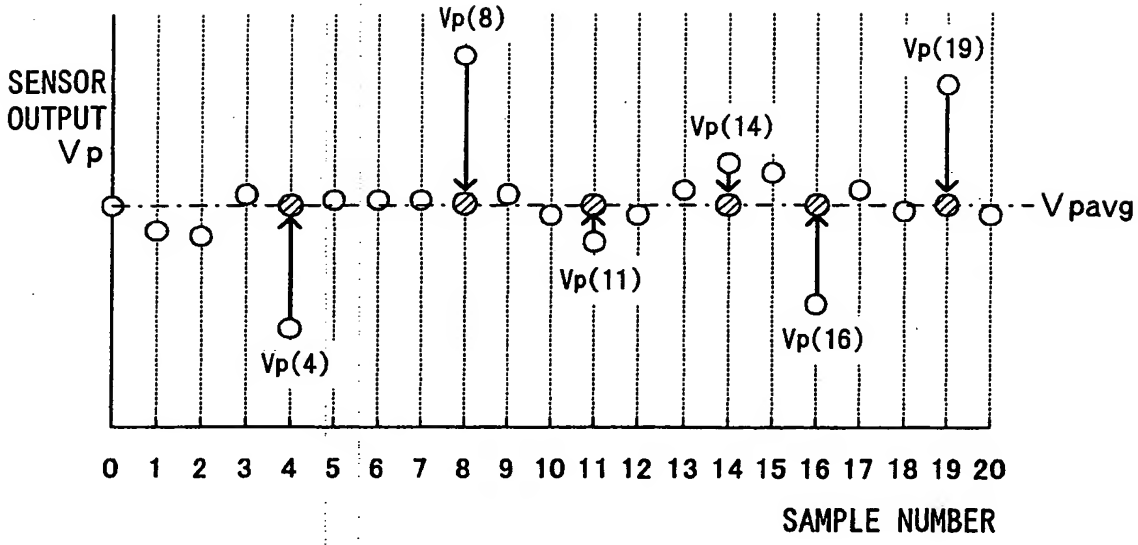

SENSOR
OUTPUT
Vp
Vp(8)
Vp(19)
Vp(14)
Vpavg
Vp(11)
Vp(16)
Vp(4)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SAMPLE NUMBER

FIG. 11A

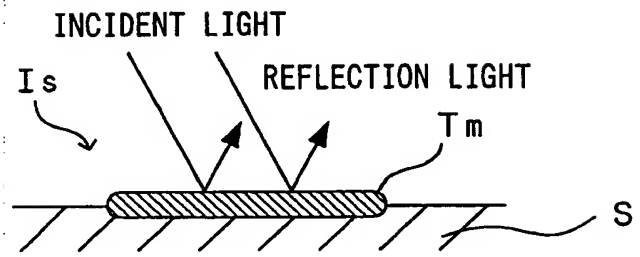


FIG. 11B

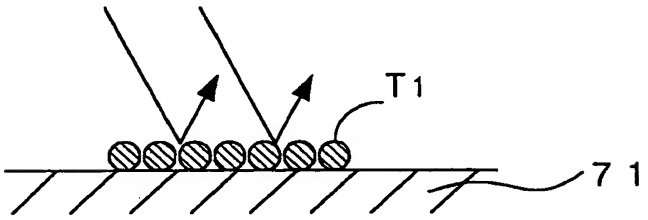


FIG. 11C

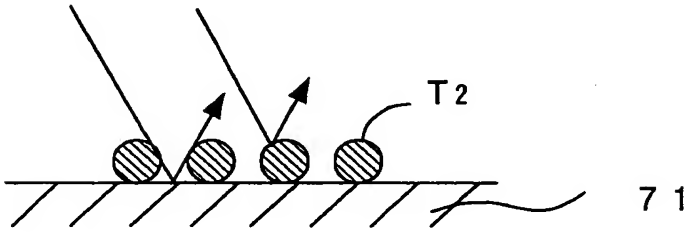


FIG. 12A

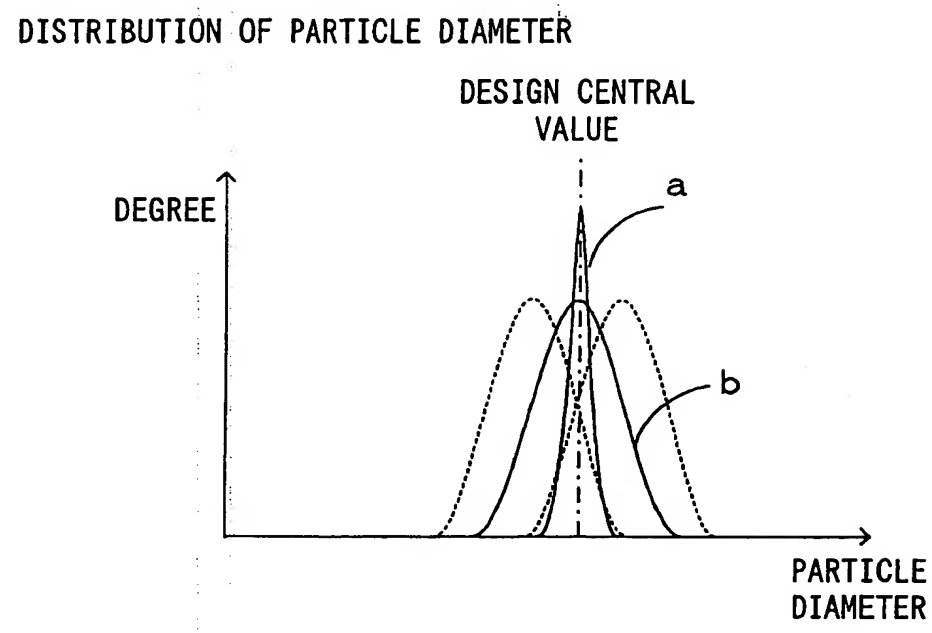


FIG. 12B

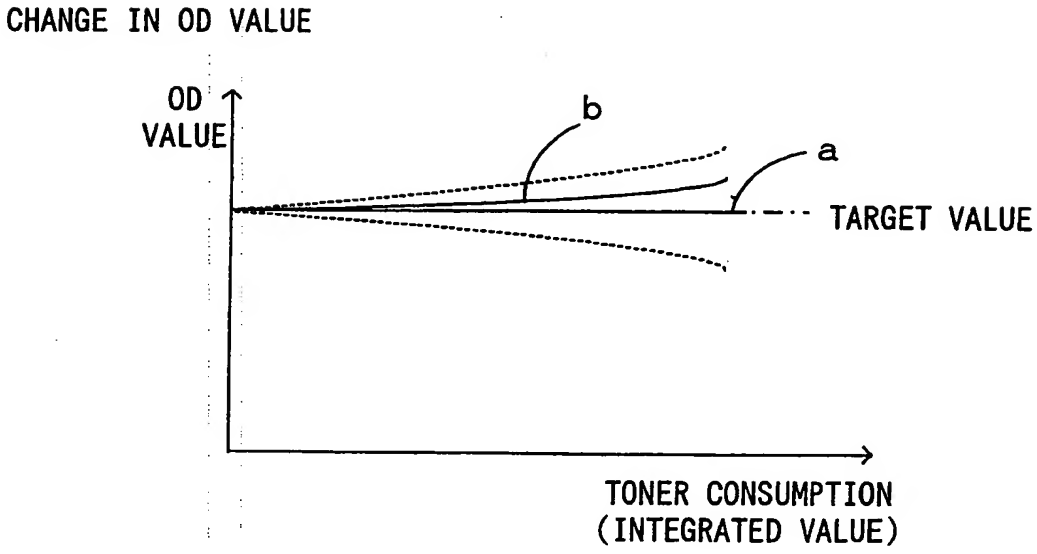


FIG. 13

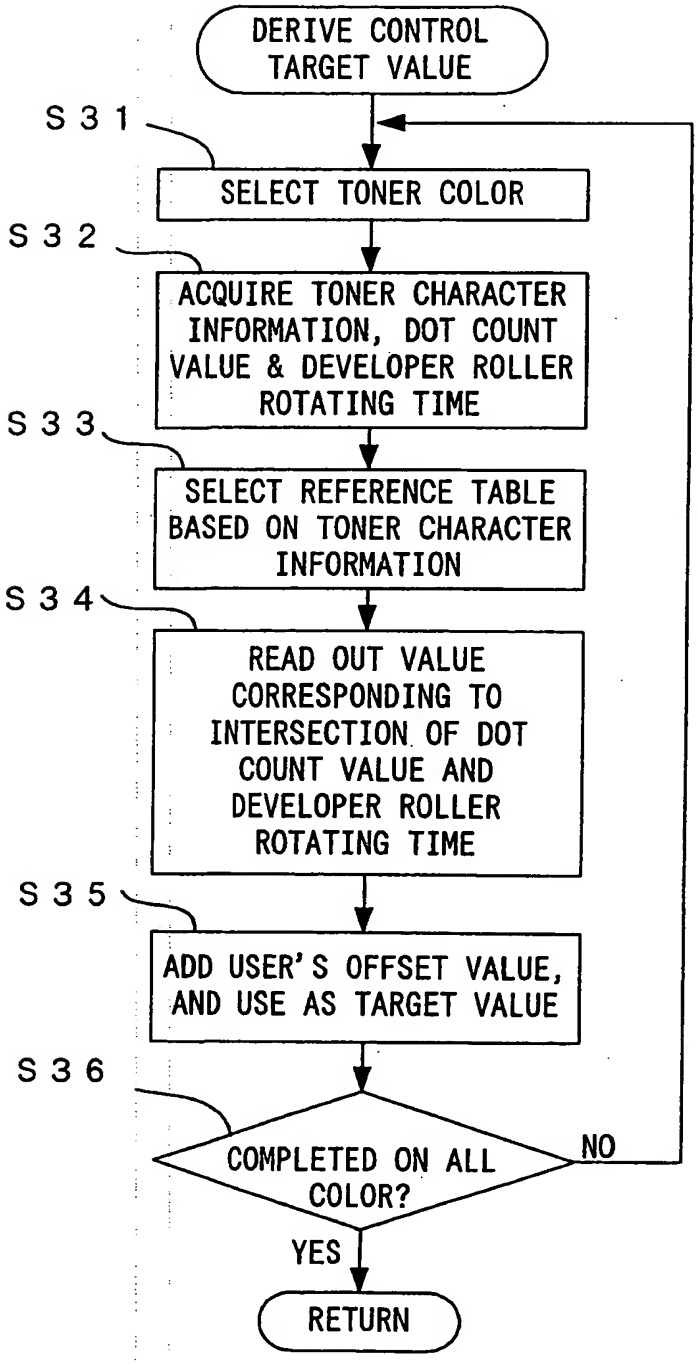

DERIVE CONTROL TARGET VALUE
S31
SELECT TONER COLOR
S32
ACQUIRE TONER CHARACTER INFORMATION, DOT COUNT VALUE & DEVELOPER ROLLER ROTATING TIME
S33
SELECT REFERENCE TABLE BASED ON TONER CHARACTER INFORMATION
S34
READ OUT VALUE CORRESPONDING TO INTERSECTION OF DOT COUNT VALUE AND DEVELOPER ROLLER ROTATING TIME
S35
ADD USER'S OFFSET VALUE, AND USE AS TARGET VALUE
S36
COMPLETED ON ALL COLOR?
NO
YES
RETURN

FIG. 14A HIGH-DENSITY PATCH IMAGE

TONER CHARACTER INFORMATION ="0"		DEVELOPER ROLLER ROTATING TIME (sec)			
		~1325	~3975	~6625	~10600
DOT COUNT VALUE	~1000000	0.990	0.988	0.984	0.982
	~2000000	0.988	0.984	0.982	0.982
	~6666666	0.984	0.982	0.982	0.982
	~12000000	0.982	0.982	0.982	0.982

FIG. 14B LOW-DENSITY PATCH IMAGE

TONER CHARACTER INFORMATION ="0"		DEVELOPER ROLLER ROTATING TIME (sec)			
		~1325	~3975	~6625	~10600
DOT COUNT VALUE	~1000000	0.185	0.182	0.181	0.180
	~2000000	0.182	0.181	0.180	0.180
	~6666666	0.181	0.180	0.180	0.180
	~12000000	0.180	0.180	0.180	0.180

FIG. 15

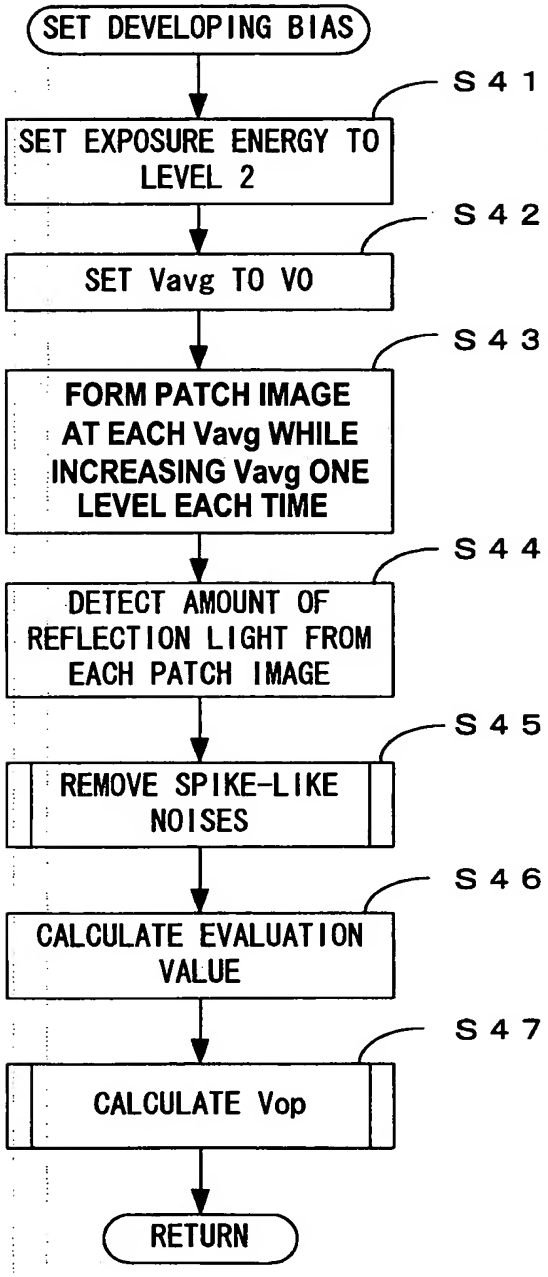

SET DEVELOPING BIAS
S41
SET EXPOSURE ENERGY TO LEVEL 2
S42
SET Vavg TO V0
S43
FORM PATCH IMAGE AT EACH Vavg WHILE INCREASING Vavg ONE LEVEL EACH TIME
S44
DETECT AMOUNT OF REFLECTION LIGHT FROM EACH PATCH IMAGE
S45
REMOVE SPIKE-LIKE NOISES
S46
CALCULATE EVALUATION VALUE
S47
CALCULATE Vop
RETURN

FIG. 16

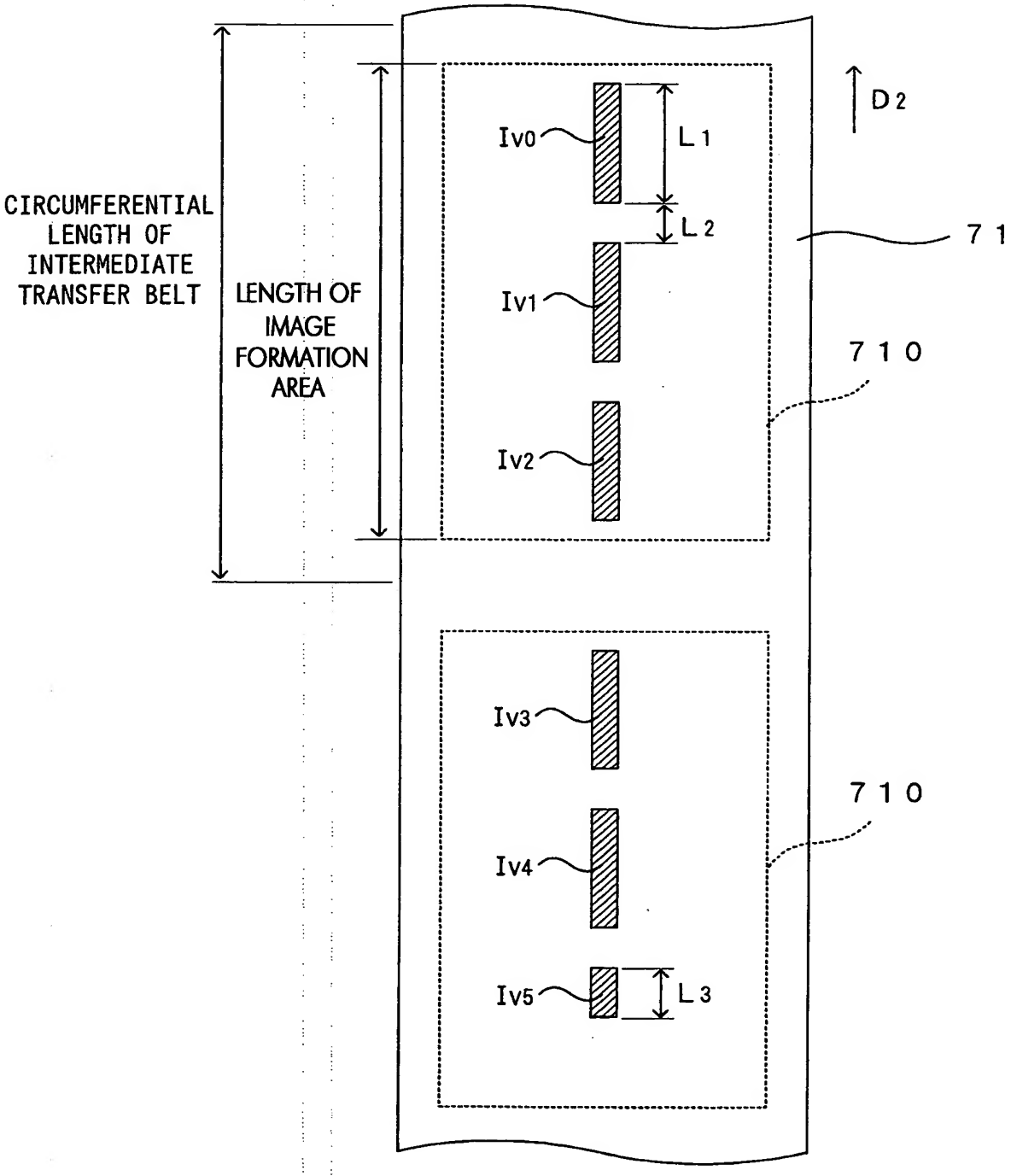

CIRCUMFERENTIAL LENGTH OF INTERMEDIATE TRANSFER BELT
LENGTH OF IMAGE FORMATION AREA
Iv0
L1
L2
Iv1
Iv2
Iv3
Iv4
Iv5
L3
D2
71
710
710

FIG. 17B

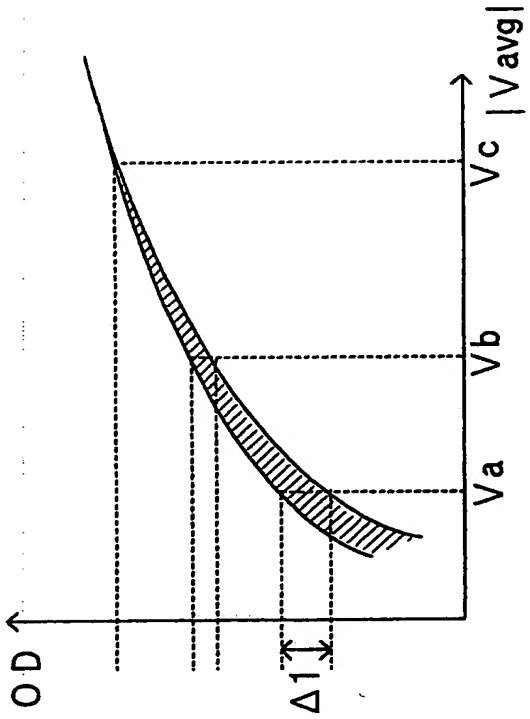


FIG. 17A

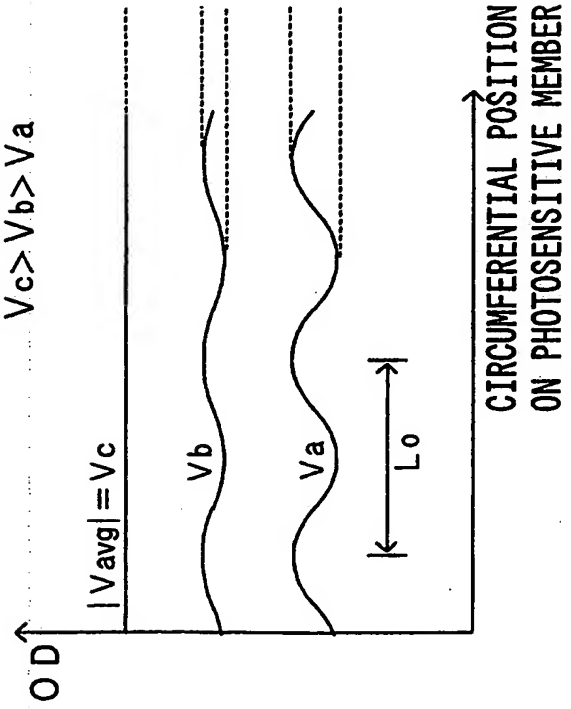


FIG. 18

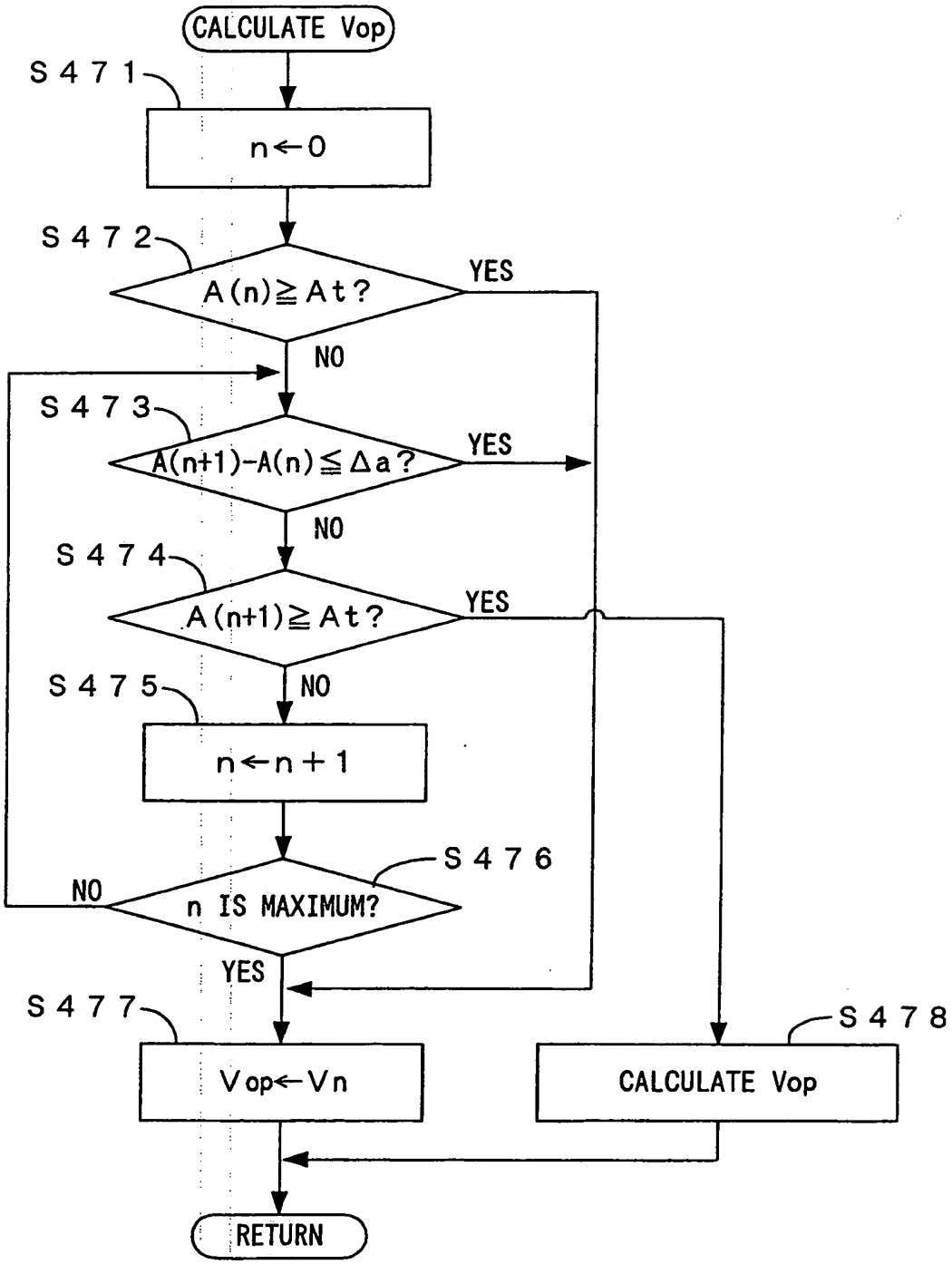

CALCULATE Vop
S471
n←0
S472
A(n)≧At?
YES
NO
S473
A(n+1)-A(n)≦Δa?
YES
NO
S474
A(n+1)≧At?
YES
NO
S475
n←n+1
S476
NO
n IS MAXIMUM?
YES
S477
Vop←Vn
S478
CALCULATE Vop
RETURN

FIG. 19

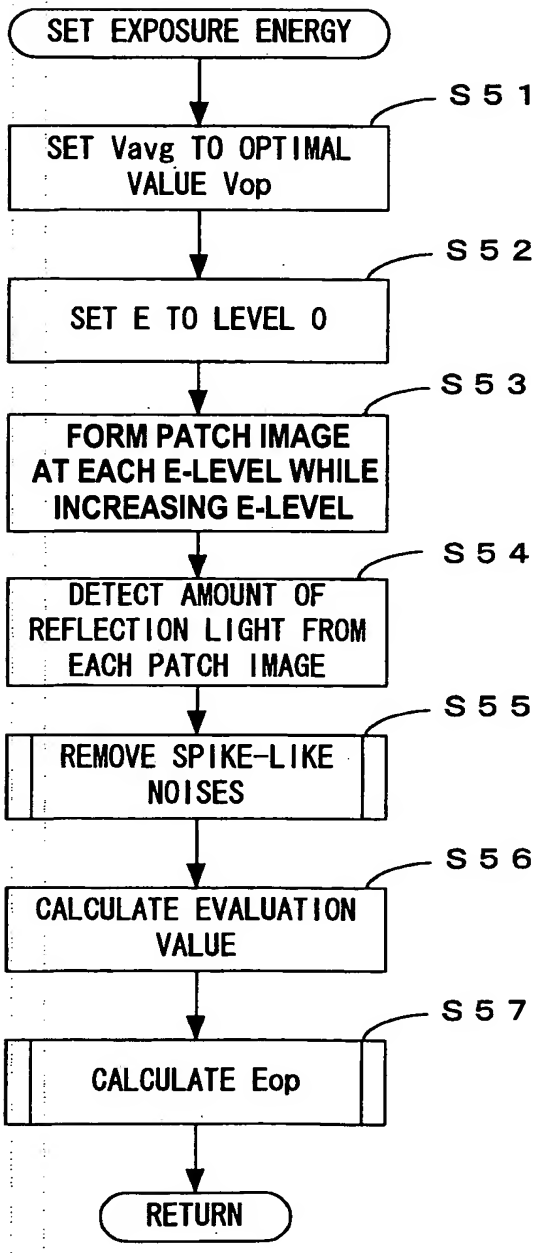

SET EXPOSURE ENERGY
S51
SET Vavg TO OPTIMAL VALUE Vop
S52
SET E TO LEVEL 0
S53
FORM PATCH IMAGE AT EACH E-LEVEL WHILE INCREASING E-LEVEL
S54
DETECT AMOUNT OF REFLECTION LIGHT FROM EACH PATCH IMAGE
S55
REMOVE SPIKE-LIKE NOISES
S56
CALCULATE EVALUATION VALUE
S57
CALCULATE Eop
RETURN

FIG. 20

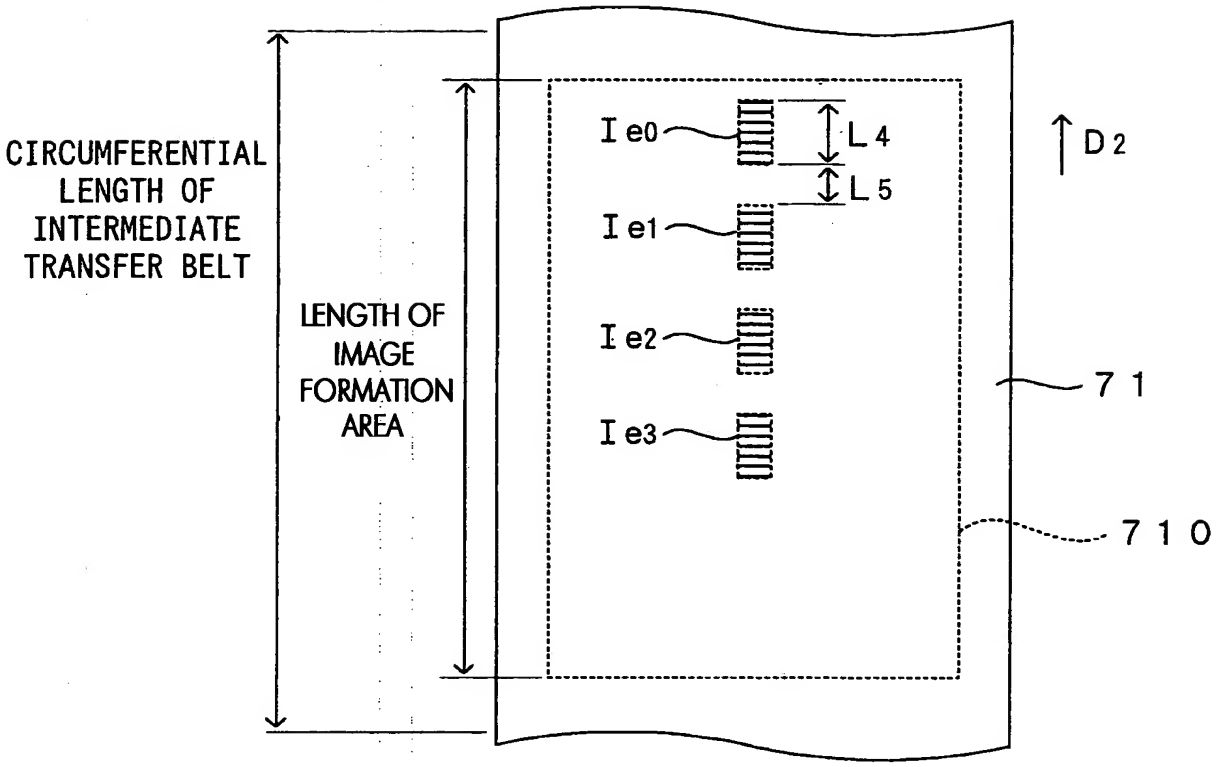

CIRCUMFERENTIAL LENGTH OF INTERMEDIATE TRANSFER BELT
LENGTH OF IMAGE FORMATION AREA
Ie0
Ie1
Ie2
Ie3
L4
L5
D2
71
710

FIG. 21

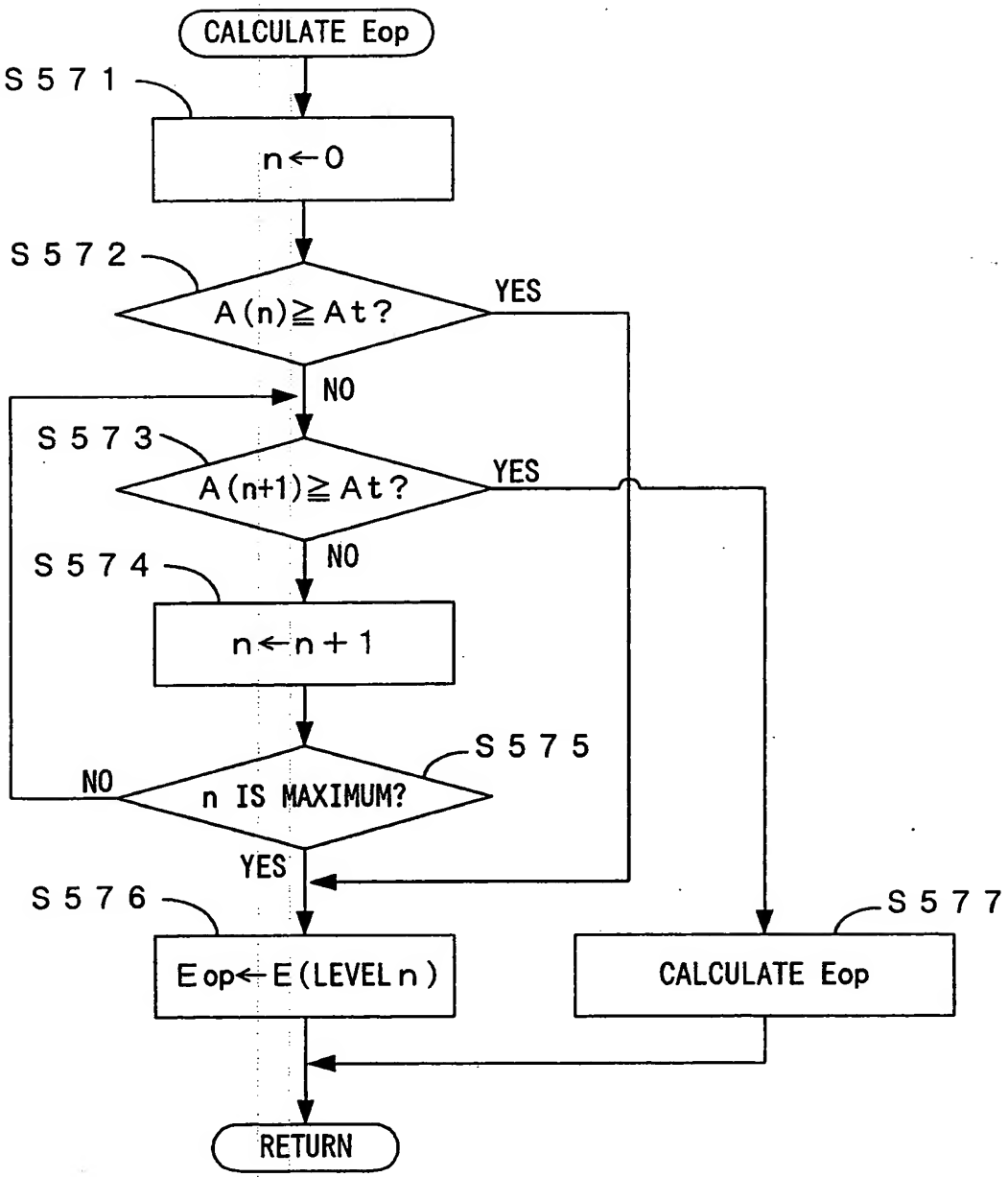

CALCULATE Eop
S571
n←0
S572
A(n)≧At?
YES
NO
S573
A(n+1)≧At?
YES
NO
S574
n←n+1
S575
NO
n IS MAXIMUM?
YES
S576
Eop←E(LEVEL n)
S577
CALCULATE Eop
RETURN

FIG. 22

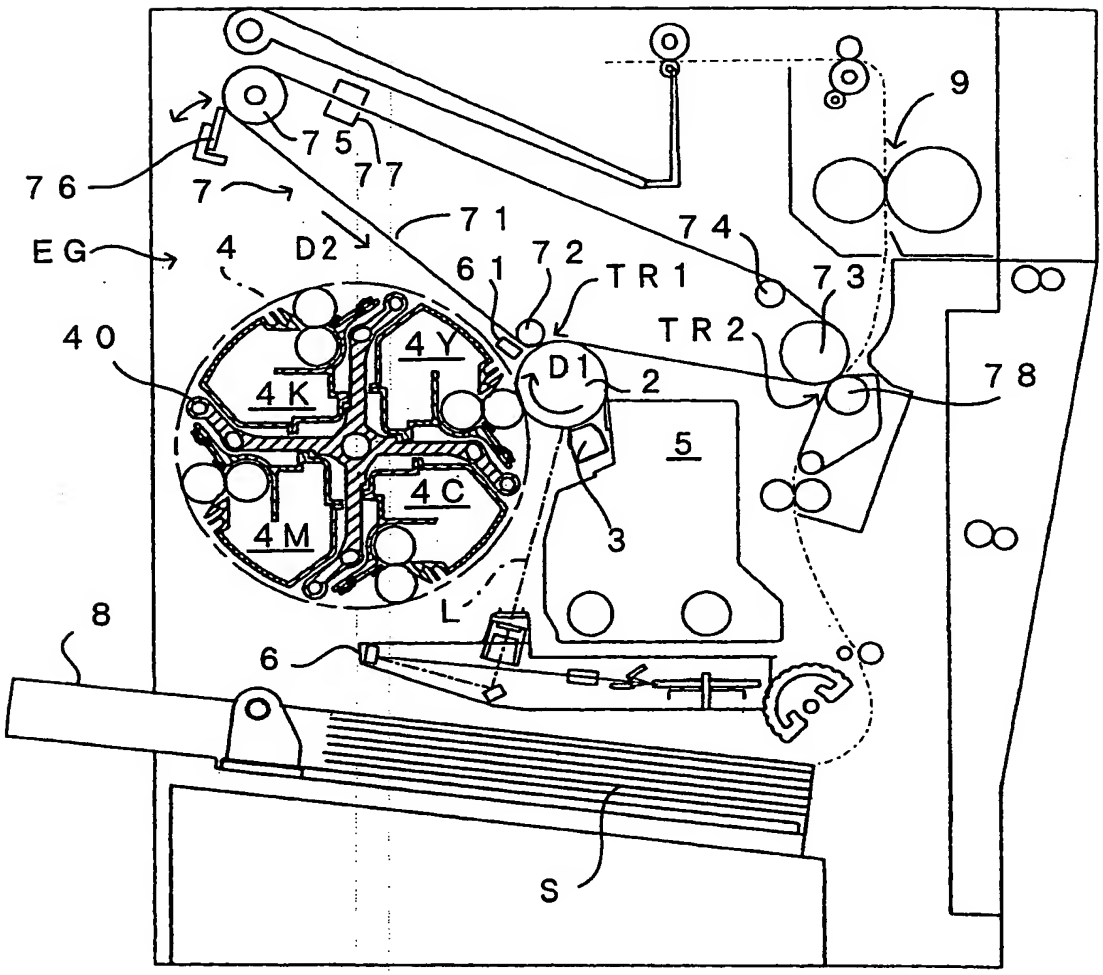

9
75
77
76
7
71
74
EG
4
D2
61
72
TR1
73
TR2
40
4Y
4K
D1
2
78
5
4C
4M
3
L
8
6
S

FIG. 23

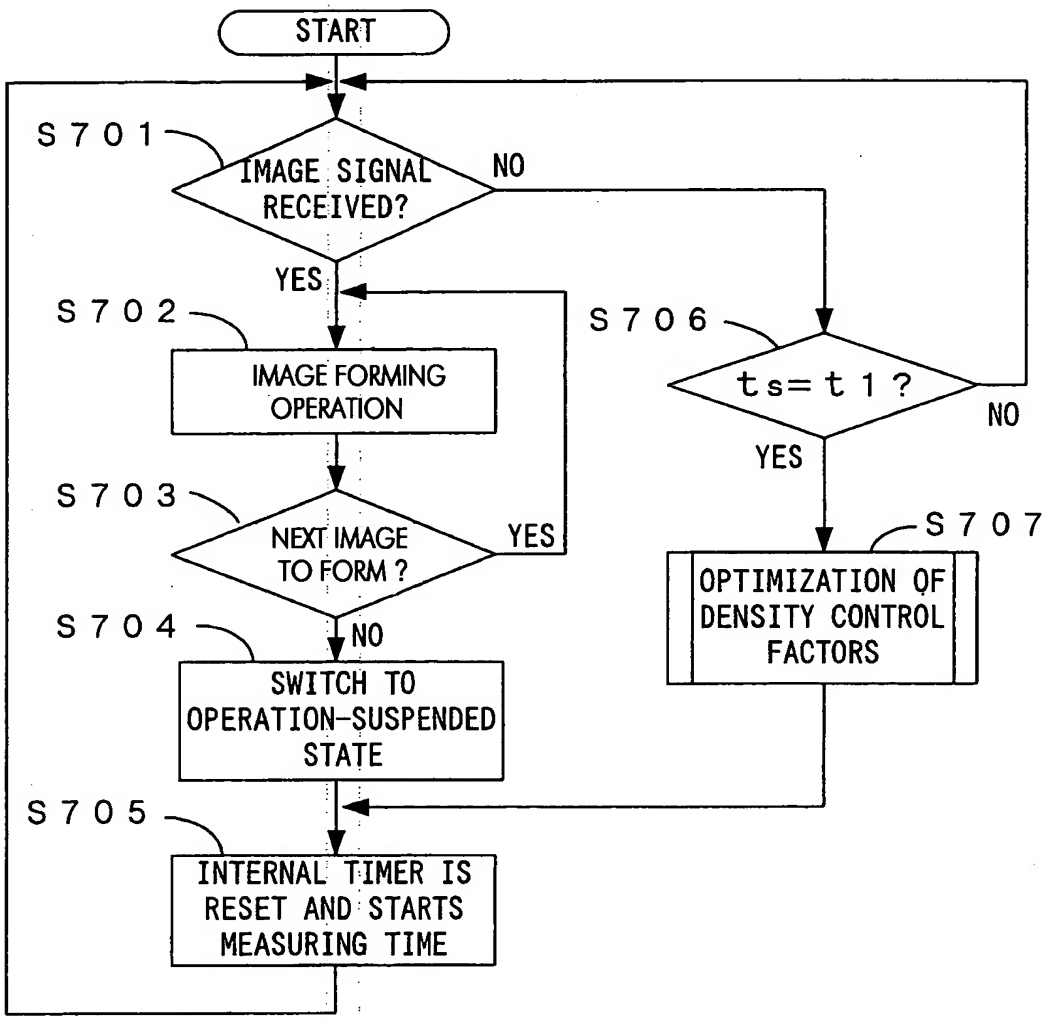

START
S701
IMAGE SIGNAL RECEIVED?
NO
YES
S702
IMAGE FORMING OPERATION
S703
NEXT IMAGE TO FORM ?
YES
NO
S704
SWITCH TO OPERATION-SUSPENDED STATE
S705
INTERNAL TIMER IS RESET AND STARTS MEASURING TIME
S706
ts=t1?
NO
YES
S707
OPTIMIZATION OF DENSITY CONTROL FACTORS

FIG. 24A

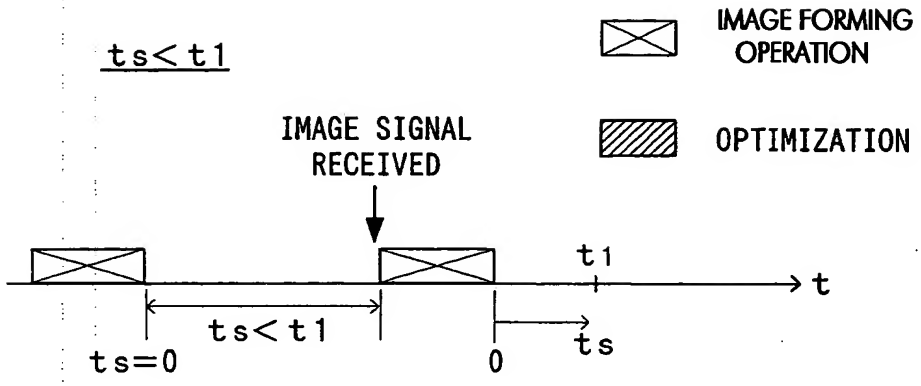


FIG. 24B

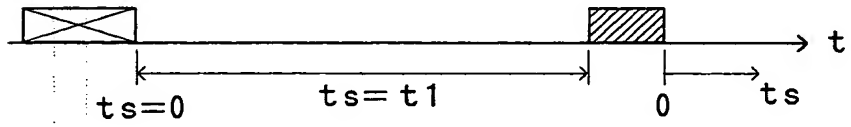


FIG. 25

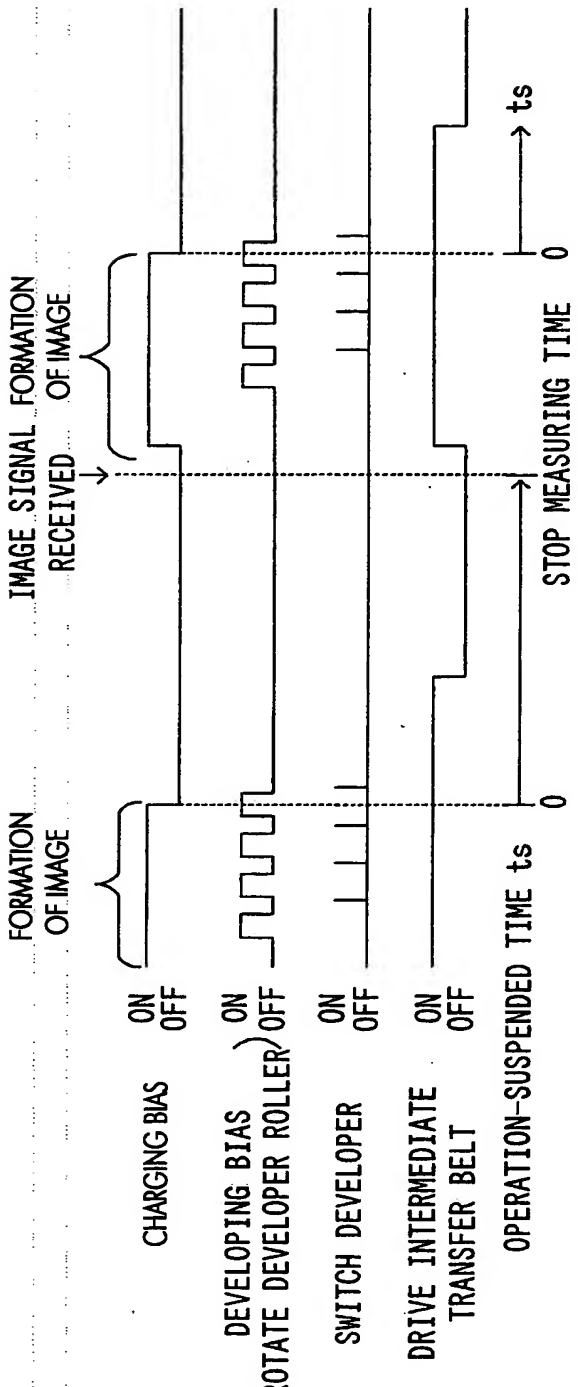
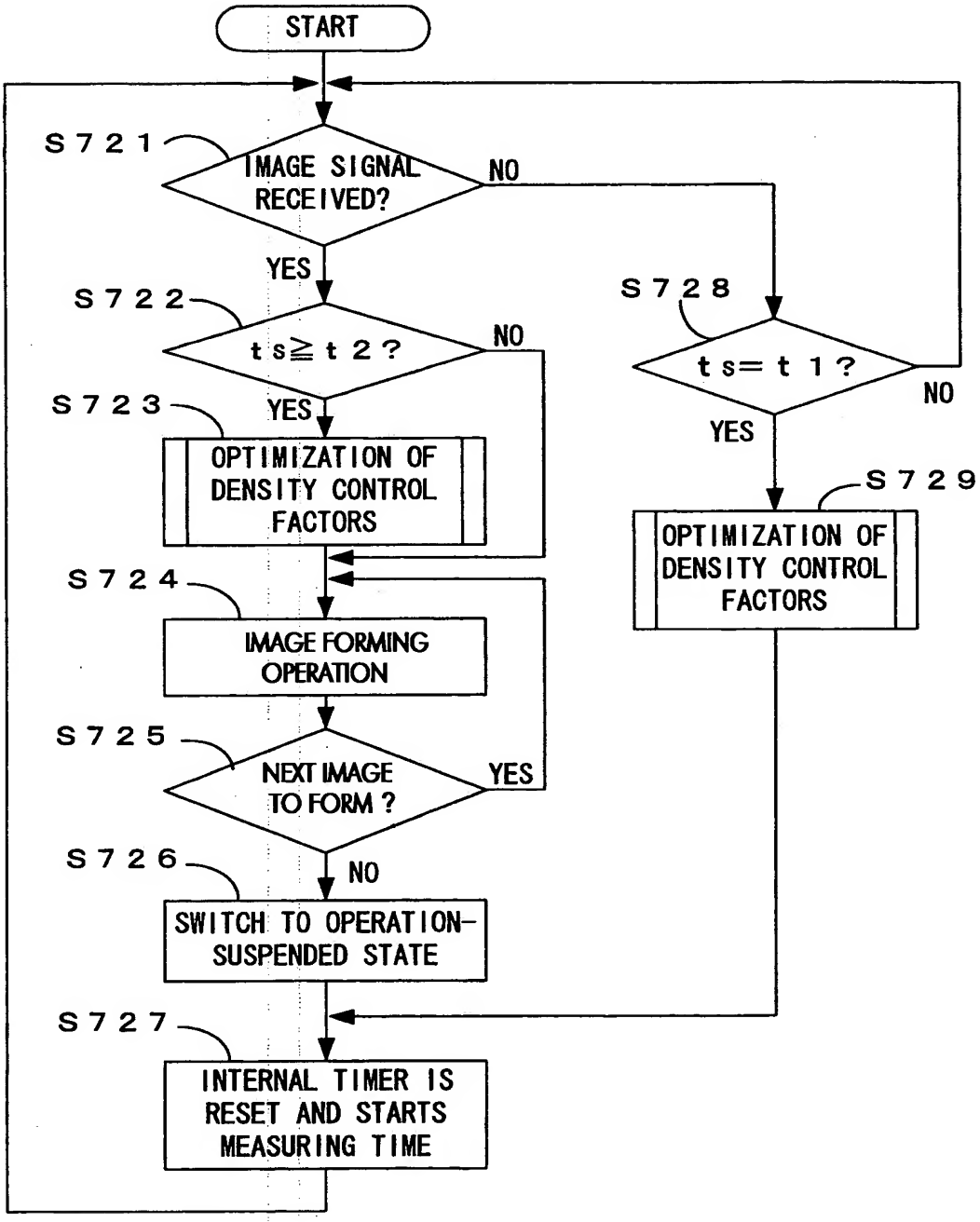

FORMATION OF IMAGE
IMAGE SIGNAL RECEIVED
FORMATION OF IMAGE
CHARGING BIAS
ON
OFF
DEVELOPING BIAS
ROTATE DEVELOPER ROLLER
ON
OFF
SWITCH DEVELOPER
ON
OFF
DRIVE INTERMEDIATE TRANSFER BELT
ON
OFF
OPERATION-SUSPENDED TIME ts
0
STOP MEASURING TIME
0
ts

FIG. 26


START
S721
IMAGE SIGNAL RECEIVED?
NO
YES
S722
ts≧t2?
NO
YES
S723
OPTIMIZATION OF DENSITY CONTROL FACTORS
S724
IMAGE FORMING OPERATION
S725
NEXT IMAGE TO FORM ?
YES
NO
S726
SWITCH TO OPERATION-SUSPENDED STATE
S727
INTERNAL TIMER IS RESET AND STARTS MEASURING TIME
S728
ts=t1?
NO
YES
S729
OPTIMIZATION OF DENSITY CONTROL FACTORS

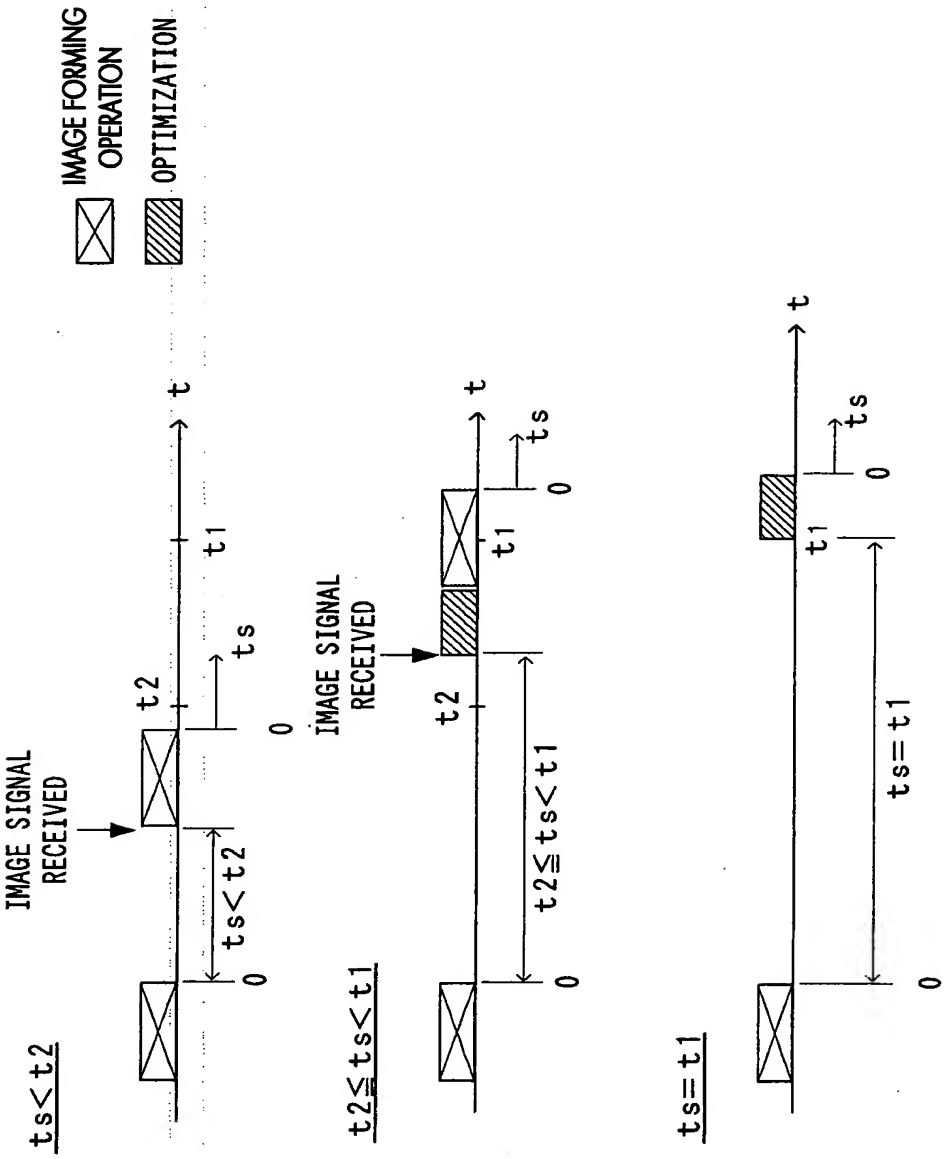
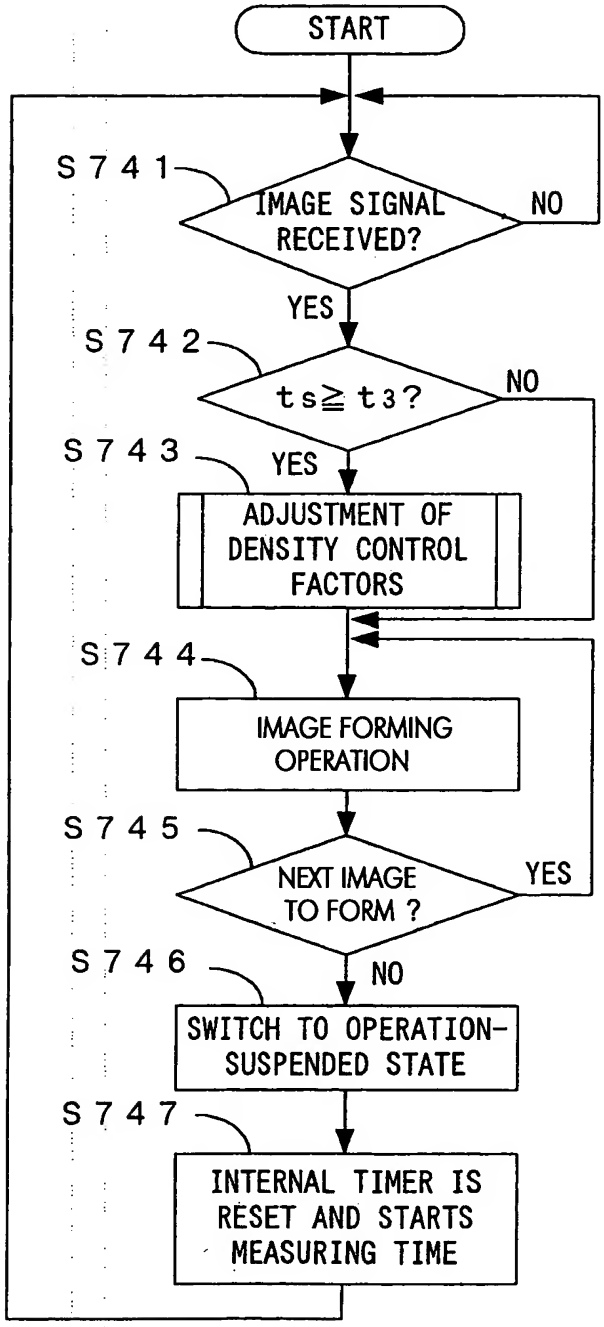


FIG. 27A

FIG. 27B

FIG. 27C

FIG. 28


START
S741
IMAGE SIGNAL RECEIVED?
NO
YES
S742
ts≧t3?
NO
S743
YES
ADJUSTMENT OF DENSITY CONTROL FACTORS
S744
IMAGE FORMING OPERATION
S745
NEXT IMAGE TO FORM ?
YES
S746
NO
SWITCH TO OPERATION-SUSPENDED STATE
S747
INTERNAL TIMER IS RESET AND STARTS MEASURING TIME

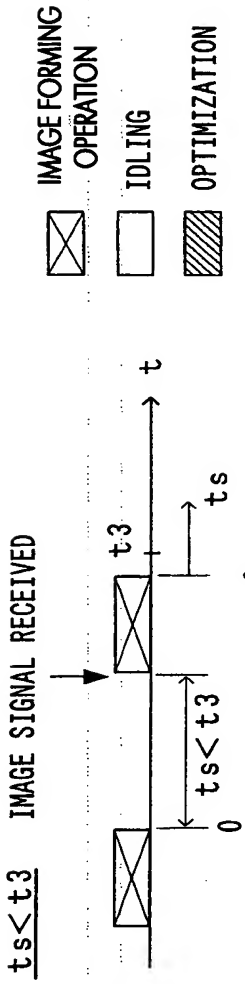


FIG. 29A

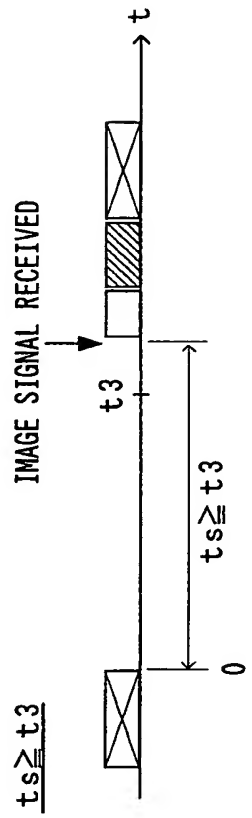


FIG. 29B

FIG. 30

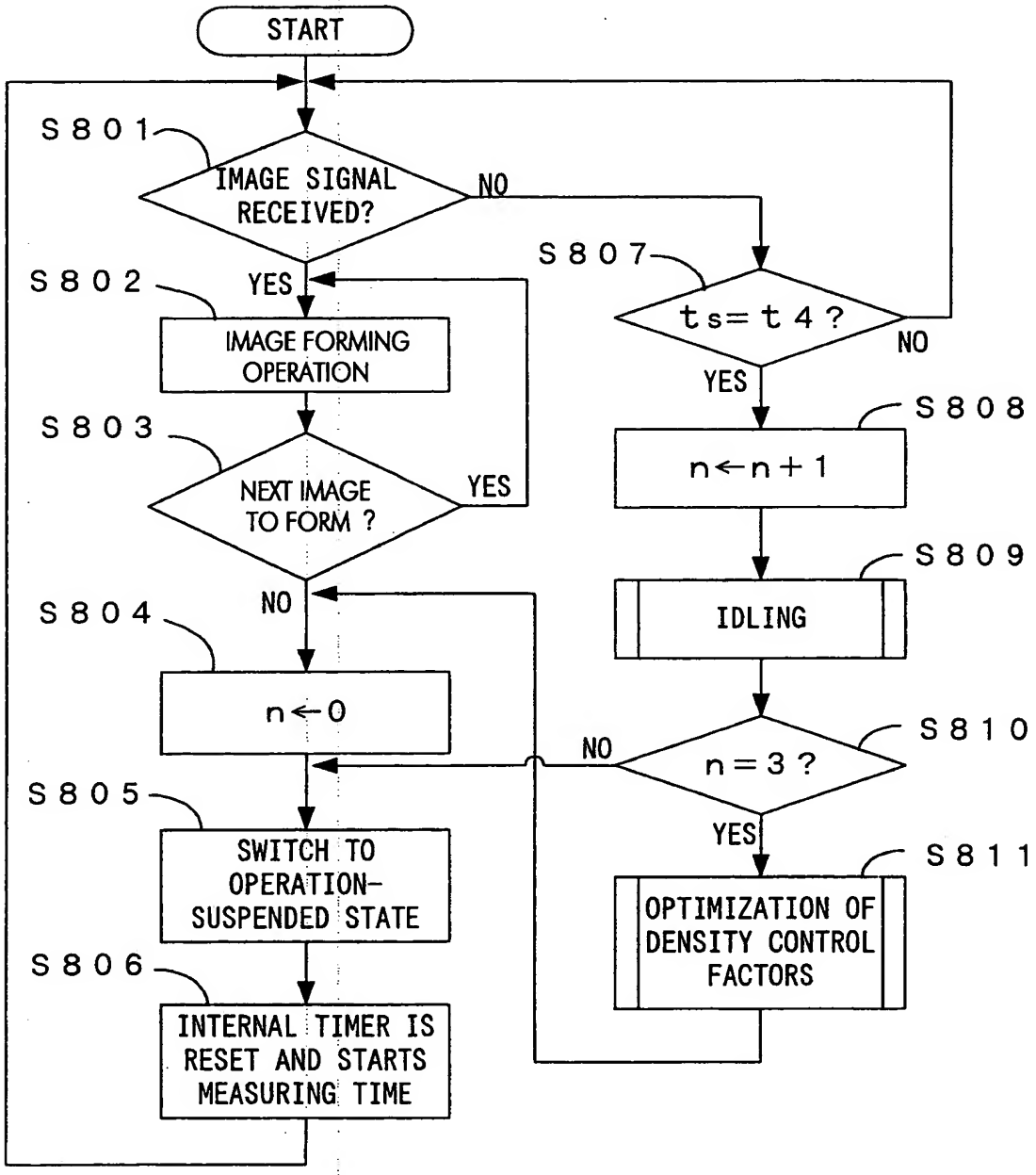
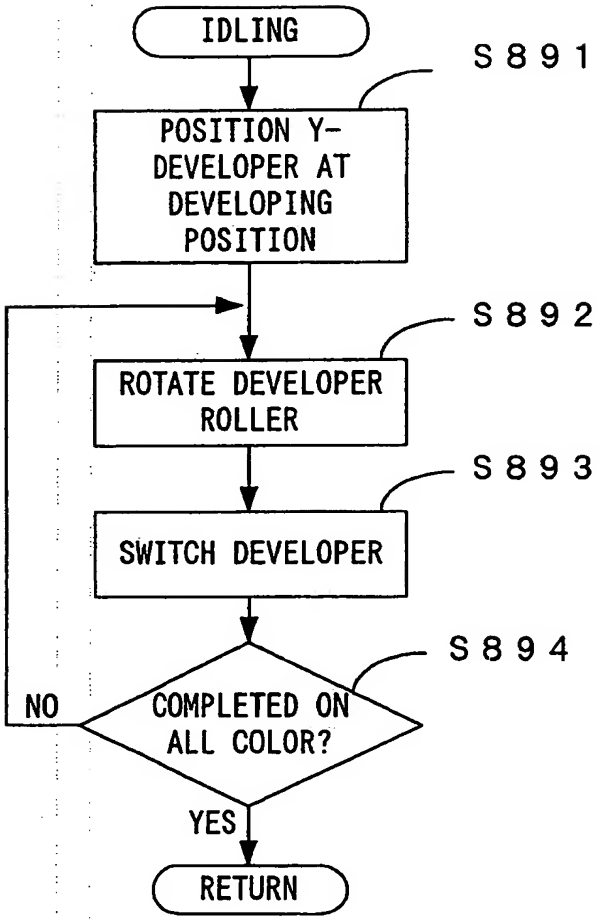

START
S801
IMAGE SIGNAL RECEIVED?
NO
YES
S802
IMAGE FORMING OPERATION
S803
NEXT IMAGE TO FORM ?
YES
NO
S804
n←0
S805
SWITCH TO OPERATION-SUSPENDED STATE
S806
INTERNAL TIMER IS RESET AND STARTS MEASURING TIME
S807
ts=t4?
NO
YES
S808
n←n+1
S809
IDLING
S810
n=3?
NO
YES
S811
OPTIMIZATION OF DENSITY CONTROL FACTORS

FIG. 31


IDLING
S891
POSITION Y-DEVELOPER AT DEVELOPING POSITION
S892
ROTATE DEVELOPER ROLLER
S893
SWITCH DEVELOPER
S894
COMPLETED ON ALL COLOR?
NO
YES
RETURN

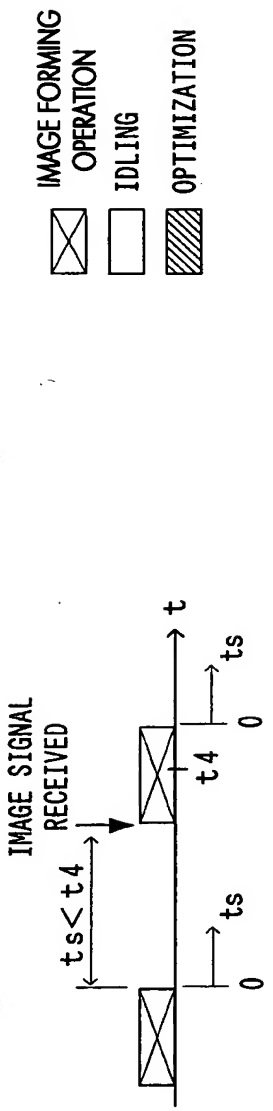


FIG. 32A

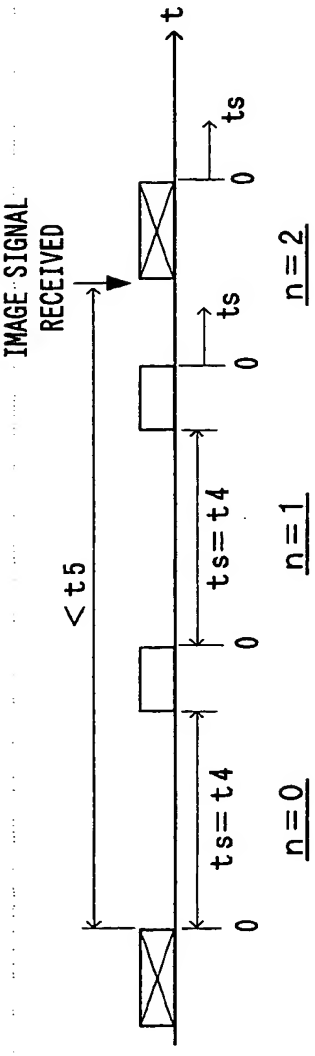


FIG. 32B

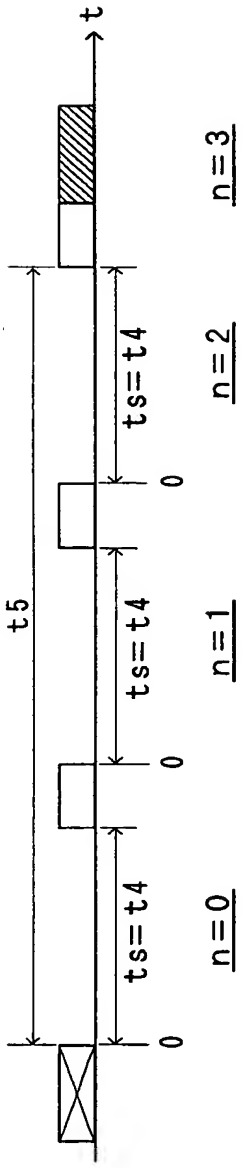


FIG. 32C

FIG. 33

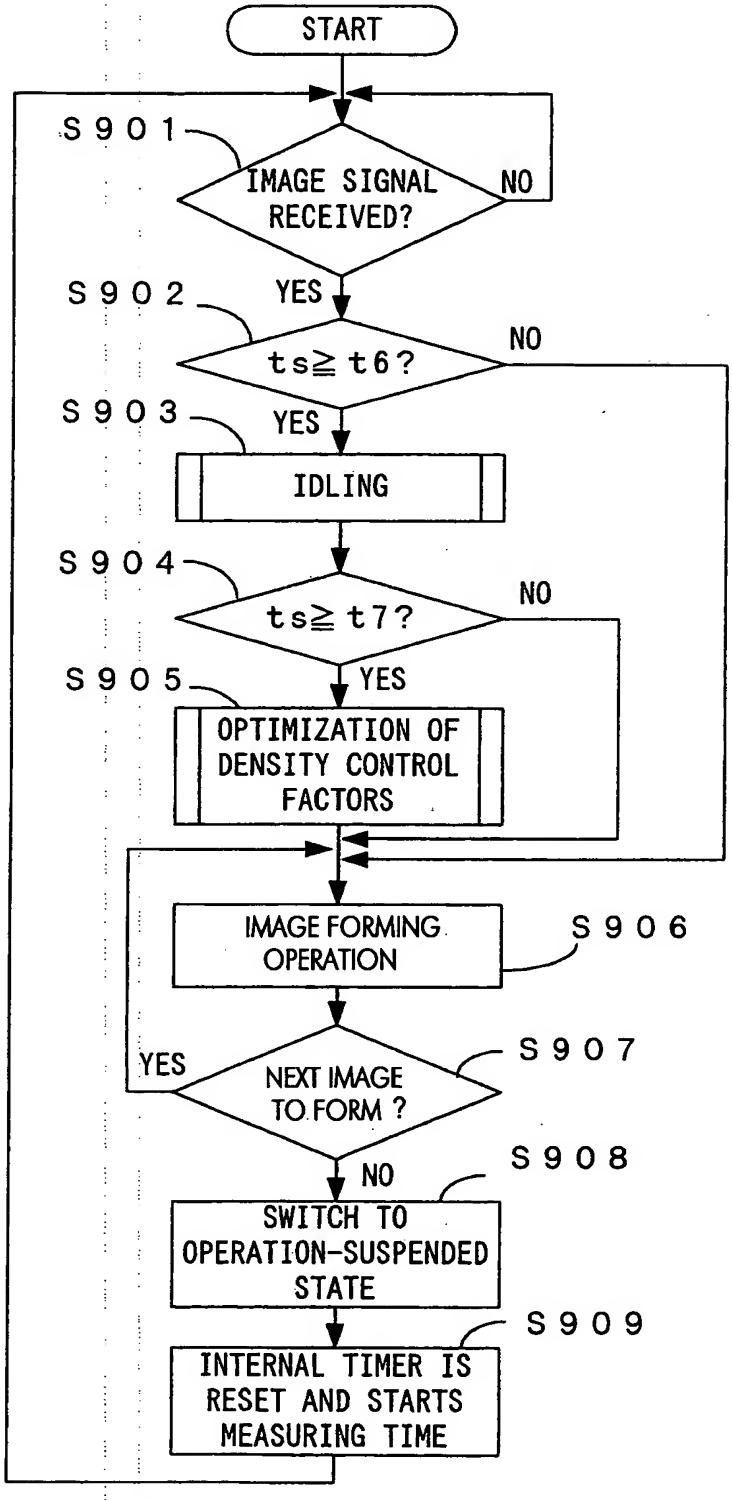

START
S901
IMAGE SIGNAL RECEIVED?
NO
YES
S902
ts≧t6?
NO
YES
S903
IDLING
S904
ts≧t7?
NO
YES
S905
OPTIMIZATION OF DENSITY CONTROL FACTORS
IMAGE FORMING OPERATION
S906
YES
NEXT IMAGE TO FORM ?
S907
NO
S908
SWITCH TO OPERATION-SUSPENDED STATE
S909
INTERNAL TIMER IS RESET AND STARTS MEASURING TIME

FIG. 34A

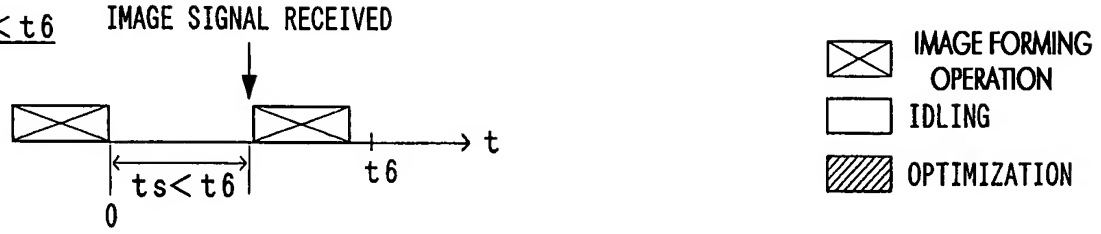


FIG. 34B

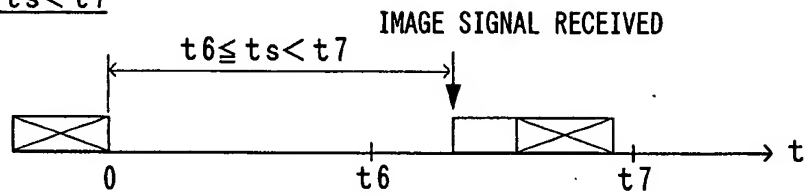
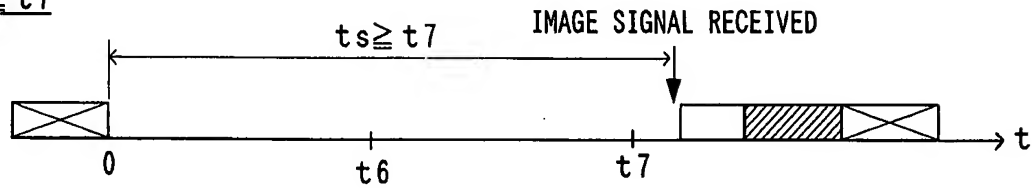


FIG. 34C



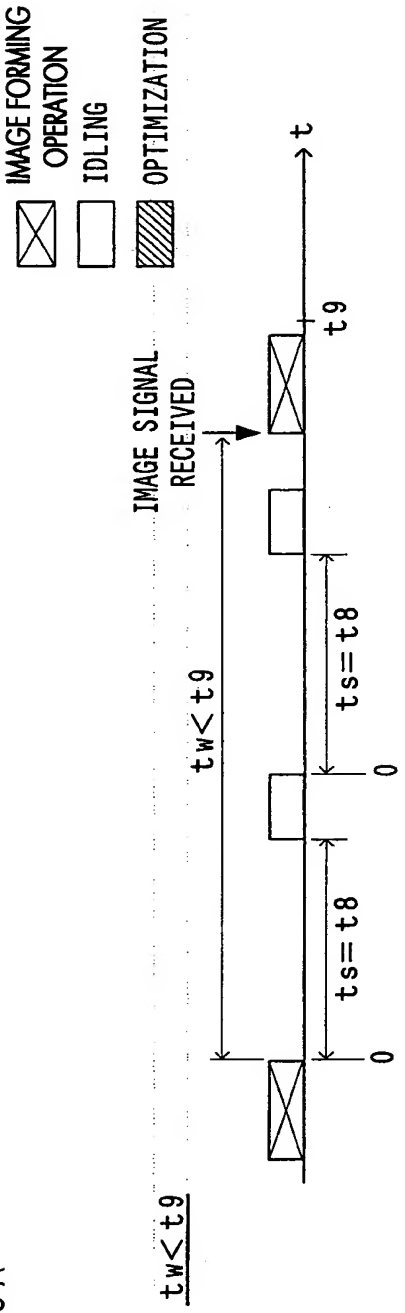


FIG. 35A

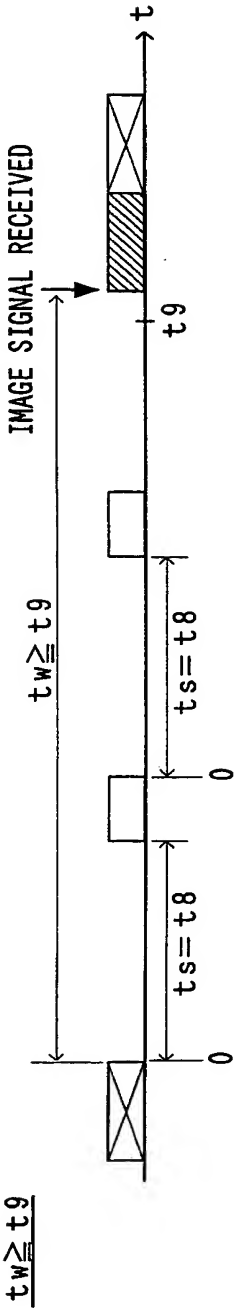


FIG. 35B